The drawings have been changed as requested by the Examiner. In particular, proposed drawing changes to Figs. 11-12 are attached hereto, with the proposed changes being shown in red ink.

Interview

Applicant would like to thank Examiners Tran and Ho for the courtesy extended during the personal interview held at the USPTO on July 16, 2003. During the interview, it was agreed that the current rejections lack merit and would be withdrawn upon filing of the instant response. However, the Examiners indicated that a new search would be conducted. The substance of the interview is set forth below.

General

For purposes of example, and without limitation, certain example embodiments of this invention relate to a multi-gate thin film transistor (TFT) for use in an LCD, imager, or the like. In a first embodiment of the instant invention shown in Figs. 1-5, a TFT 10 includes a pair of gate electrodes 18a, 18b located over respective channel regions 20a, 20b which are defined in semiconductor layer 14. The semiconductor layer 14 of the TFT 10 further includes heavily doped source/drain (S/D) regions 28a, 28b. A key aspect of the first embodiment is the provision of first and second lightly doped regions 24 and 26 having different carrier concentrations between each channel 20 and the adjacent S/D region 28, where the lightly doped region 24 closer to the channel 20 has a carrier concentration lower than that of the lightly doped region 26 closer to the S/D region (e.g., pgs. 21-23 and Fig. 5). For example, Fig. 3 of the instant application illustrates lightly doped regions 24a and 26a between channel 20a and S/D region 28a, where the lightly

doped region 24a closer to the channel 20a has a carrier concentration lower than that of the lightly doped region 26a closer to the S/D region 28a. See also lightly doped regions 24b and 26b between channel 20b and S/D region 28b. It has surprisingly been found that by providing a pair of such lightly doped regions with different carrier concentrations between a channel and an adjacent S/D region, the carrier profile becomes gentler, which reduces leakage current between the channel and S/D; and it is also possible for higher on-current to be realized (e.g., pgs. 23-24). In other words, this structure unexpectedly allows leakage current to be reduced, and ON-state current increased, at the same time.

Another embodiment of this invention is shown in Fig. 7. The Fig. 7 embodiment utilizes a TFT channel having both a doped channel region 72 and an intrinsic channel region 74 (e.g., pg. 40). It has surprisingly been found that by using both a doped and intrinsic channel regions in the same channel as shown in Fig. 7, the intensity of the electric field is weakened at the end of the drain and leakage current can be reduced while at the same time the ON-state current can be substantially increased (e.g., pg. 40, paragraph [0117]).

Claim 1

Claim 1 stands rejected under 35 U.S.C. Section 103(a) as being allegedly unpatentable over Kunii (US 5,412,493). This Section 103(a) rejection is respectfully traversed for at least the following reasons.

Claim 1 requires "a **first** lightly doped region, which has the first conductivity type and is located between the first channel region and the first heavily doped region; a **second** lightly doped region, which has the first conductivity type and is located between the

second channel region and the second heavily doped region; a **third** lightly doped region, which has the first conductivity type, has a carrier concentration different from that of the first lightly doped region and is located between the first lightly doped region and the first channel region; and a **fourth** lightly doped region, which has the first conductivity type, has a carrier concentration different from that of the second lightly doped region and is located between the second lightly doped region and the second channel region." In other words, claim 1 requires two lightly doped regions with different carrier concentrations between a first channel and the adjacent S/D, and two additional lightly doped regions with different carrier concentrations between the second channel and the adjacent S/D.

For example, Fig. 3 of the instant application illustrates first lightly doped region 26a, which has the first conductivity type and is located between the first channel region 20a and the first heavily doped region 28a; a second lightly doped region 26b, which has the first conductivity type and is located between the second channel region 20b and the second heavily doped region 28b; a third lightly doped region 24a, which has the first conductivity type, has a carrier concentration different from that of the first lightly doped region 26a and is located between the first lightly doped region 26a and the first channel region 20a; and a fourth lightly doped region 24b, which has the first conductivity type, has a carrier concentration different from that of the second lightly doped region 26b and is located between the second lightly doped region 26b and the second channel region 20b. In other words, as shown in Fig. 3 of the instant application, at least ***two*** lightly doped regions 24a, 26a with different carrier concentrations are provided between a first channel 20a and the adjacent S/D 28a, and at least ***two*** additional lightly doped regions 24b, 26b with different

carrier concentrations are provided between the second channel 20b and the adjacent S/D 28b. As explained above, this structure unexpectedly allows leakage current to be reduced, and ON-state current increased, at the same time.

The cited art fails to disclose or suggest the aforesaid underlined aspects of claim 1. In direct contrast with claim 1, Kunii only discloses a *single* LDD region between each channel and the adjacent S/D. For example, in Fig. 16 of Kunii only has a *single* LDD region 61 between channel 2 and S/D 3. Thus, Kunii clearly <u>fails</u> to disclose or suggest at least *two* lightly doped regions with different carrier concentrations between a first channel and the adjacent S/D, and at least *two* additional lightly doped regions with different carrier concentrations provided between the second channel and the adjacent S/D as called for in claim 1.

Kunii's structure is undesirable. In particular, Kunii's structure is similar to that described in paragraphs [0009] to [0022] in the Background section of the instant specification. In particular, a conventional TFT such as Kunii's cannot reduce leakage current and increase ON-state current at the same time. In contrast, the invention of claim 1 may allow this advantage to be achieved in certain example instances.

In view of the above, it can be seen that Kunii cannot anticipate or render obvious the invention of claim 1. Kunii is entirely unrelated to the claim.

<u>Claim 14</u>

Claim 14 requires "a first lightly doped region located between the first channel region and the first heavily doped region; and a second lightly doped region located between the second channel region and the second heavily doped region, and wherein the

first channel region includes a first intrinsic channel region and the second channel region includes a second intrinsic channel region." For example, and without limitation, Fig. 7 of the instant application illustrates a TFT channel having both a doped channel region 72 and an *intrinsic* channel region 74 (e.g., pg. 40). It has surprisingly been found that by using both a doped and intrinsic channel regions in the same channel as shown in Fig. 7, the intensity of the electric field is weakened at the end of the drain and leakage current can be reduced while at the same time the ON-state current can be substantially increased (e.g., pg. 40, paragraph [0117]).

Kunii fails to disclose or suggest the aforesaid underlined aspects of claim 14. In particular, Kunii fails to disclose or suggest intrinsic channel regions. In contrast with claim 14, Kunii's teaches that B+ ions are implanted into the entire Si thin film 102 through oxide 103 (e.g., see Fig. 5(c); and col. 10, lines 2-7). Thus, given this implantation in Kunii, no intrinsic channel region can exist. Kunii fails to disclose or suggest that any portion of the channels remain undoped. For at least this reason, the rejection of claim 14 over Kunii is fundamentally flawed and must be withdrawn.

Claim 16

Claim 16 requires that "the first channel region includes a doped channel region between the first intrinsic channel region and the intermediate region, while the second channel region includes a doped channel region between the second intrinsic channel region and the intermediate region." For example, Fig. 7 of the instant application illustrates that one channel region includes a doped channel region 72a between an intrinsic channel region 74a and the intermediate region 22; and another channel region which includes a doped

channel region 72b between an intrinsic channel region 74b and the intermediate region 22. Again, the cited art fails to disclose or suggest this aspect of claim 16.

Conclusion

For at least the foregoing reasons, it is respectfully requested that all rejections be withdrawn. All claims are in condition for allowance. If any minor matter remains to be resolved, the Examiner is invited to telephone the undersigned with regard to the same.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: ______________________
Joseph A. Rhoa
Reg. No. 37,515

JAR:caj
1100 North Glebe Road, 8th Floor
Arlington, VA 22201-4714
Telephone: (703) 816-4000
Facsimile: (703) 816-4100